

### AMENDMENTS TO THE CLAIMS

Following is a listing of all claims in the application, which listing supersedes all previously presented claims.

#### Listing of the Claims:

1. (Currently Amended) A printed circuit board including a dielectric substrate and integrated with a two-axis fluxgate sensor, comprising:
  - a first rectangular ring type soft magnetic core arranged lengthwise along a first axial direction;
  - a first excitation coil ~~portion~~ winding around the first soft magnetic core;
  - a first pick-up coil ~~portion~~ winding around the first soft magnetic core;
  - a second rectangular ring type soft magnetic core arranged lengthwise along a second axial direction, the second axial direction being perpendicular to the first axial direction;
  - a second excitation coil ~~portion~~ winding around the second soft magnetic core; and
  - a second pick-up coil ~~portion~~ winding around the second soft magnetic core;wherein the first soft magnetic core is disposed on a first surface ~~[[side]]~~ of the dielectric substrate and the second soft magnetic core is disposed on a second surface ~~[[side]]~~ of the dielectric substrate opposite the first surface, and
  - ~~wherein the first excitation coil portion is electrically connected to the second excitation coil portion by a first via and the first pick-up coil portion is electrically connected to the second pick-up coil portion by a second via.~~

2-16. (Cancelled).

17. (Currently Amended) The printed circuit board as claimed in claim 1,  
wherein:

~~each of the first and second~~ soft magnetic core ~~cores~~ comprises a first parallel pair of bar-type portions extending along the first axial direction and a second parallel pair of bar-type portions extending along the second axial direction, the second parallel pair of bar-type portions being co-planar with and connected to the first parallel pair of bar-type portions,

the second soft magnetic core includes a third parallel pair of bar-type portions extending along the second axial direction and a fourth parallel pair of bar-type portions extending along the first axial direction, the fourth parallel pair of bar-type portions being co-planar with and connected to the third parallel pair of bar-type portions, [[and]]

the first and second parallel pairs of bar-type portions of the first soft magnetic core ~~cores~~ extend along a first plane that is substantially parallel to the dielectric substrate,

the third and fourth parallel pairs of bar-type portions of the second soft magnetic core extend along a second plane that is substantially parallel to the dielectric substrate, and

~~wherein~~ each of the first and second soft magnetic cores serves as a closed magnetic path.

18. (Currently Amended) The printed circuit board as claimed in claim 17,  
wherein:

the first excitation coil ~~portion~~ separately winds around each bar-type portion of the first parallel pair of bar-type portions of the first soft magnetic core in a solenoid pattern extending along the first axial direction, and

the second excitation coil ~~portion~~ separately winds around each bar-type portion of the third ~~second~~ parallel pair of bar-type portions of the second soft magnetic core in a solenoid pattern extending along the second axial direction.

19. (Currently Amended) The printed circuit board as claimed in claim 18,  
wherein:

the first pick-up coil ~~portion~~ winds around both bar-type portions of the first parallel pair of bar-type portions of the first soft magnetic core together in a solenoid pattern extending along the first axial direction, and

the second pick-up coil ~~portion~~ winds around both bar-type portions of the third ~~second~~ parallel pair of bar-type portions of the second magnetic core together in a solenoid pattern extending along the second axial direction.

20. (Currently Amended) The printed circuit board as claimed in claim 17,  
wherein:

~~along a plane substantially perpendicular to the dielectric substrate and the first axial direction,~~ the first excitation coil ~~portion~~ separately winds around one of the bar-type portions of the first parallel pair of bar-type portions of the first soft magnetic core in a solenoid pattern extending along the first direction and the first pick-up coil ~~portion~~ separately winds around the other of the bar-type portions of the first parallel pair of bar-type portions of the first soft magnetic core in a solenoid pattern extending along the first axial direction, and

~~along a plane substantially perpendicular to the dielectric substrate and the first axial direction,~~ the second excitation coil ~~portion~~ separately winds around one of the bar-type portions of the third ~~second~~ parallel pair of bar-type portions of the second soft magnetic core in a solenoid pattern extending along the second axial direction and the second pick-up coil ~~portion~~ separately winds around the other of the bar-type portions of the third ~~second~~ parallel pair of bar-type portions of the second soft magnetic core in a solenoid pattern extending along the second axial direction.

21. (Currently Amended) The printed circuit board as claimed in claim 1 [[17]], ~~including a plurality of the first vias and a plurality of the second vias,~~ wherein:

~~each of the first excitation coil portion and the first pick-up coil portion~~ includes a plurality of first excitation coil upper portions on the first surface [[side]] of the dielectric substrate and a plurality of corresponding first excitation coil lower portions on the first surface [[side]] of the dielectric substrate, the plurality of first excitation coil upper portions being arranged further from the first surface [[side]] of the dielectric substrate than the plurality of corresponding first excitation coil lower portions,

~~each of the second excitation coil portion and the second pick-up coil portion~~ includes a plurality of second excitation coil upper portions on the second surface [[side]] of the dielectric substrate and a plurality of corresponding second excitation coil lower portions on the second surface [[side]] of the dielectric substrate, the plurality of second excitation coil upper portions being arranged further from the second surface [[side]] of the dielectric substrate than the plurality of corresponding second excitation coil lower portions,

the plurality of first excitation coil upper portions ~~of the first pick-up coil portion and the plurality of first upper portions of the first excitation coil portion~~ corresponding correspond to a patterned first upper conductive layer [[film]],

the plurality of corresponding first excitation coil lower portions ~~of the first pick-up coil portion and the plurality of first lower portions of the first excitation coil~~ corresponding correspond to a patterned first lower conductive layer [[film]],

the plurality of first excitation coil upper portions ~~of the first pick-up coil portion~~ being are electrically connected with corresponding ~~the plurality of corresponding first excitation coil~~ lower portions ~~of the first pick-up coil portion~~ by way of conductive respective ~~ones of the second vias,~~

the plurality of second excitation coil upper portions correspond to a patterned conductive layer,

the plurality of corresponding second excitation coil lower portions correspond to a patterned conductive layer, and

~~the plurality of first second excitation coil upper portions of the first excitation coil portion being~~ are electrically connected with corresponding ~~the plurality of corresponding first second excitation coil lower portions of the first excitation coil portion by way of~~ conductive ~~respective ones of the first~~ vias.

22. (Currently Amended) The printed circuit board as claimed in claim 21, wherein:

~~each of the plurality of first excitation coil upper portions of the first excitation coil portion~~ substantially faces the plurality of first corresponding first excitation coil lower portions ~~portion of the first excitation coil portion~~ with at least a portion ~~one of the bar type portions of the first pair of parallel bar type portions of the first soft magnetic core extending therebetween~~ ~~between and overlapping the first upper portion and the corresponding first lower portion of the first excitation coil portion, and~~

~~each of the plurality of second excitation coil upper portions of the second excitation coil portion~~ substantially faces the plurality of second corresponding second excitation coil lower portions ~~portion of the second excitation coil portion~~ with at least a portion ~~one of the bar type portions of the second pair of parallel bar type portions of the second soft magnetic core extending therebetween~~ ~~between and overlapping the second upper portion and the corresponding second lower portion of the second excitation coil portion.~~

23. (Currently Amended) The printed circuit board as claimed in claim 68 [[22]], wherein:

~~each of the plurality of first pick-up coil upper portions of the first pick-up coil portion~~ substantially faces the plurality of first corresponding first pick-up coil lower portions

~~portion of the first pick-up coil portion with at least a portion of one of the bar-type portions of the first pair of parallel bar-type portions of the first soft magnetic core extending therebetween between and overlapping the first upper portion and the corresponding first lower portion of the first pick-up coil portion, and~~

~~each of the plurality of second pick-up coil upper portions of the second pick-up coil portion substantially faces the plurality of second corresponding second pick-up coil lower portions portion of the second pick-up coil portion with at least a portion of one of the bar-type portions of the second pair of parallel bar-type portions of the second soft magnetic core extending therebetween between and overlapping the second upper portion and the corresponding second lower portion of the second pick-up coil portion.~~

24-25. (Cancelled).

26. (Currently Amended) The printed circuit board as claimed in claim 17, wherein:

the first excitation coil ~~portion~~ alternately winds around each bar-type portion of the first parallel pair of bar-type portions of the first soft magnetic core together in a figure-eight pattern extending along the first axial direction, and

the second excitation coil ~~portion~~ alternately winds around each bar-type portion of the third ~~second~~ parallel pair of bar-type portions of the second soft magnetic core together in a figure eight pattern extending along the second axial direction.

27. (Currently Amended) The printed circuit board as claimed in claim 26, wherein:

the first pick-up coil ~~portion~~ winds around both bar-type portions of the first parallel pair of bar-type portions of the first soft magnetic core together in a solenoid pattern extending along the first axial direction, and

the second pick-up coil ~~portion~~ winds around both bar-type portions of the third ~~second~~ parallel pair of bar-type portions of the second magnetic core together in a solenoid pattern extending along the second axial direction.

28. (Previously Presented) The printed circuit board as claimed in claim 27 ~~[[26]]~~, wherein:

~~the first pick-up coil portion winds around both bar-type portions of the first parallel pair of bar-type portions of the first soft magnetic core together in a solenoid pattern extending along the first axial direction,~~

~~the second pick-up coil portion winds around both bar-type portions of the second parallel pair of bar-type portions of the second soft magnetic core together in a solenoid pattern extending along the second axial direction,~~

the first excitation coil and the first pick-up coil wrap around the first soft magnetic core as a single layer,

the second excitation coil and the second pick-up coil wrap around the second soft magnetic core as a single layer,

the winding of the first pick-up coil ~~portion~~ is off-set in the first axial direction from the winding of the first excitation coil ~~portion~~, and

the winding of the second pick-up coil ~~portion~~ is off-set in the second axial direction from the winding of the second excitation coil ~~portion~~.

29. (Currently Amended) The printed circuit board as claimed in claim 26, wherein:

the first pick-up coil ~~portion~~ separately winds around each bar-type portion of the first parallel pair of bar-type portions of the first soft magnetic core in a solenoid pattern extending along the first axial direction, and

the second pick-up coil ~~portion~~ separately winds around each bar-type portion of the third ~~second~~ parallel pair of bar-type portions of the second soft magnetic core in a solenoid pattern extending along the second axial direction.

~~the winding of the first pick-up coil portion is off set from the winding of the first excitation coil portion, and~~

~~the winding of the second pick-up coil portion is off set from the winding of the second excitation coil portion.~~

30-65. (Cancelled).

66. (Currently Amended) The printed circuit board as claimed in claim 1, wherein at least a portion of the dielectric substrate is sandwiched between the first pick-up coil ~~portion~~ and the second pick-up coil ~~portion~~.

67. (Currently Amended) The printed circuit board as claimed in claim 66 ~~[[1]]~~, wherein at least a portion of the dielectric substrate is sandwiched between the first excitation coil ~~portion~~ and the second excitation coil ~~portion~~.

68. (New) The printed circuit board as claimed in claim 21, wherein:  
the first pick-up coil includes a plurality of first pick-up coil upper portions on the first surface of the dielectric substrate and a plurality of corresponding first pick-up coil lower portions on the first surface of the dielectric substrate, the plurality of first pick-up coil upper



portions being arranged further from the first surface of the dielectric substrate than the plurality of corresponding first pick-up coil lower portions,

the second pick-up coil includes a plurality of second pick-up coil upper portions on the second surface of the dielectric substrate and a plurality of corresponding second pick-up coil lower portions on the second surface of the dielectric substrate, the plurality of second pick-up coil upper portions being arranged further from the second surface of the dielectric substrate than the plurality of corresponding second pick-up coil lower portions,

the plurality of first pick-up coil upper portions correspond to a patterned conductive layer,

the plurality of corresponding first pick-up coil lower portions correspond to a patterned conductive layer,

the first pick-up coil upper portions are electrically connected with corresponding first pick-up coil lower portions by conductive vias,

the plurality of second pick-up coil upper portions correspond to a patterned conductive layer,

the plurality of corresponding second pick-up coil lower portions correspond to a patterned conductive layer, and

the second pick-up coil upper portions are electrically connected with corresponding second pick-up coil lower portions by conductive vias.

69. (New) The printed circuit board as claimed in claim 68, wherein:

the plurality of first excitation coil upper portions and the plurality of first pick-up coil upper portions correspond to a first patterned conductive layer,

the plurality of corresponding first excitation coil lower portions and the plurality of corresponding first pick-up coil lower portions correspond to a second patterned conductive layer,

the plurality of second excitation coil upper portions and the plurality of second pick-up coil upper portions correspond to a third patterned conductive layer, and

the plurality of corresponding second excitation coil lower portions and the plurality of corresponding second pick-up coil lower portions correspond to a fourth patterned conductive layer.

70. (New) The printed circuit board as claimed in claim 29, wherein:

the first excitation coil and the first pick-up coil wrap around the first soft magnetic core as a single layer,

the second excitation coil and the second pick-up coil wrap around the second soft magnetic core as a single layer,

the winding of the first pick-up coil is off-set in the first axial direction from the winding of the first excitation coil, and

the winding of the second pick-up coil is off-set in the second axial direction from the winding of the second excitation coil.